Math 229 Calculus Computer Lab Fall 19 Final b

Name: Solutions

- I will count your best 8 of the following 10 questions.
- You may only use `julia` during this exam. No calculators or cell phones.

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
	80	

Final	
Overall	

(1) Convert the following `julia` expressions to standard mathematical expressions. Use parentheses if necessary to clearly indicate the order of operations:

(a) `b-a/b+b/c`

$$b - \frac{a}{b} + \frac{b}{c}$$

(b) `cos(1/2*x^2)/3x^2`

$$\frac{\cos\left(\frac{1}{2}x^2\right)}{3x^2}$$

(2) Write out the `julia` commands for the following mathematical expressions.

(a) $f(x) = \dfrac{\cos^2(3x)}{\sqrt{4x}+3}$

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f(x) = cos(3x)^2 / ( sqrt(4x) +3 )
```

(b) $g(x) = \dfrac{\tan^{-1}(2x)}{e^{3x}-2}$

```
g(x) = atan(2x) / ( exp(3x) - 2 )
```

(3) Using your answer to the previous question, compute the following to five decimal places:

(a) $f(g(2))$

0.32100

(b) $g(f'(4.5))$

0.39684

(4) Find all solutions (to at least 4 decimal places) to the equation

$$\frac{x}{x+2}\cos^2(3x-2) = \frac{x}{2} - 50.$$

Write down the `julia` command you use.

-1.99920

100.49798

100.92667

101.38803

(5) Use `julia` to find

$$\lim_{x \to 0} \frac{\cos(5x^2) - 1}{e^{-2x^4} - 1},$$

by any method; write both the `julia` commands and your answers.

$\frac{25}{4}$

(6) Consider the function $f(x) = (x - 3x^2)e^{-x^2}$. Use `julia` to find all the critical points; write both the `julia` commands and your answers.

-0.93181

0.16217

1.10297

(7) Consider a function $f(x)$ for which $f'(x) = 2x^2 - 15\sin(x/2)$ for $0 \leq x \leq 10$. Use `julia` to find all the intervals on which the function is concave up; write both the `julia` commands and your answers.

$[1.42120, 10]$

(8) Use the built in Newton's method `newton` to find all zeros of $f(x) = 3\log(2x) + 7\sin(x)$; write both the `julia` commands and your answers.

0.26896

4.32062

4.91524

(9) Find the closest point on the curve $y = 4/x + 2$ to the point $(4, 7)$. How far away is it? Write both the `julia` commands and your answers.

(0.91987, 6.34842)

distance 3.14829

(10) Use `julia` to find the area under the curve of

$$f(x) = \frac{e^{-4x}}{\sqrt{x+3}}$$

between 3 and 8. Write both the `julia` commands and your answers.

6.14769×10^{-7}